(12) UK Patent Application (19) GB (11) 2 210 537 (13) A

(43) Date of A publication 07.06.1989

(21) Application No 8808990.9

(22) Date of filing 15.04.1988

(30) Priority data
(31) 8722381 (32) 23.09.1987 (33) GB

(71) Applicant
Space Age Electronics Limited

(Incorporated in the United Kingdom)

Spalding Hall, Victoria Road, London, NW4 2BE, United Kingdom

(72) Inventor
Walter Toubkin

(74) Agent and/or Address for Service
Marks & Clerk
57-60 Lincoln's Inn Fields, London, WC2A 3LS, United Kingdom

(51) INT CL⁴
H04B 1/04, G01D 5/00

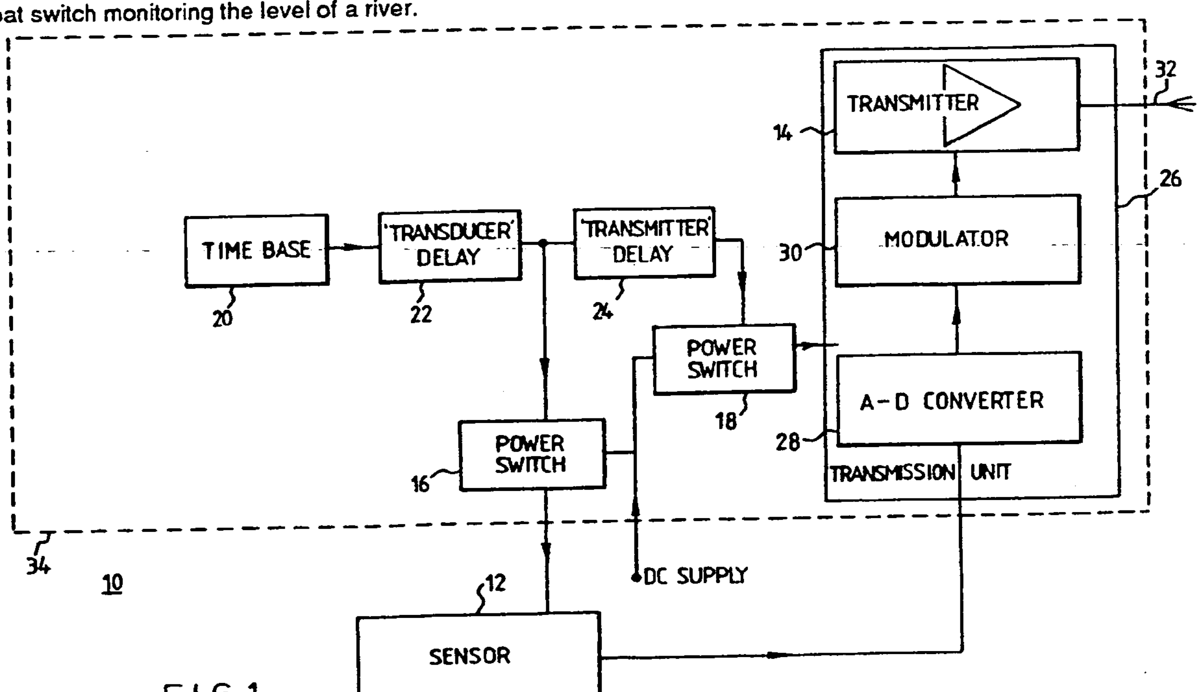
(52) UK CL (Edition J)
H4L LETX
G1H H4A1 H4B1
H4D DSX D362 D41X
U1S S2139 S2195

(56) Documents cited
None

(58) Field of search
UK CL (Edition J) G1N NAHJ NAJA JAJC, H4L LETD LETX
INT CL⁴ G01D, H04B

(54) Power saving telemetry device

(57) A telemetry device 10 has a transmitter 14 and a sensor 12 with the transmitter 14 arranged to transmit data obtained by the sensor 12. The device comprises means 18-26 for initiating data transmission at pre-set intervals, power control means 16, 20, 22 for controlling the supply of power to the sensor 12 and including time control means which control the time of commencement of the said supply of power and the duration for which power is supplied to the sensor 12 such that data collection by the sensor 12 is completed substantially at the time of each transmission. Facilities for switching between different pre-set periods and a fully quiescent state are also described. The sensor may be a pulse-echo type transducer or a float switch monitoring the level of a river.



F I G.1.

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

GB 2 210 537 A

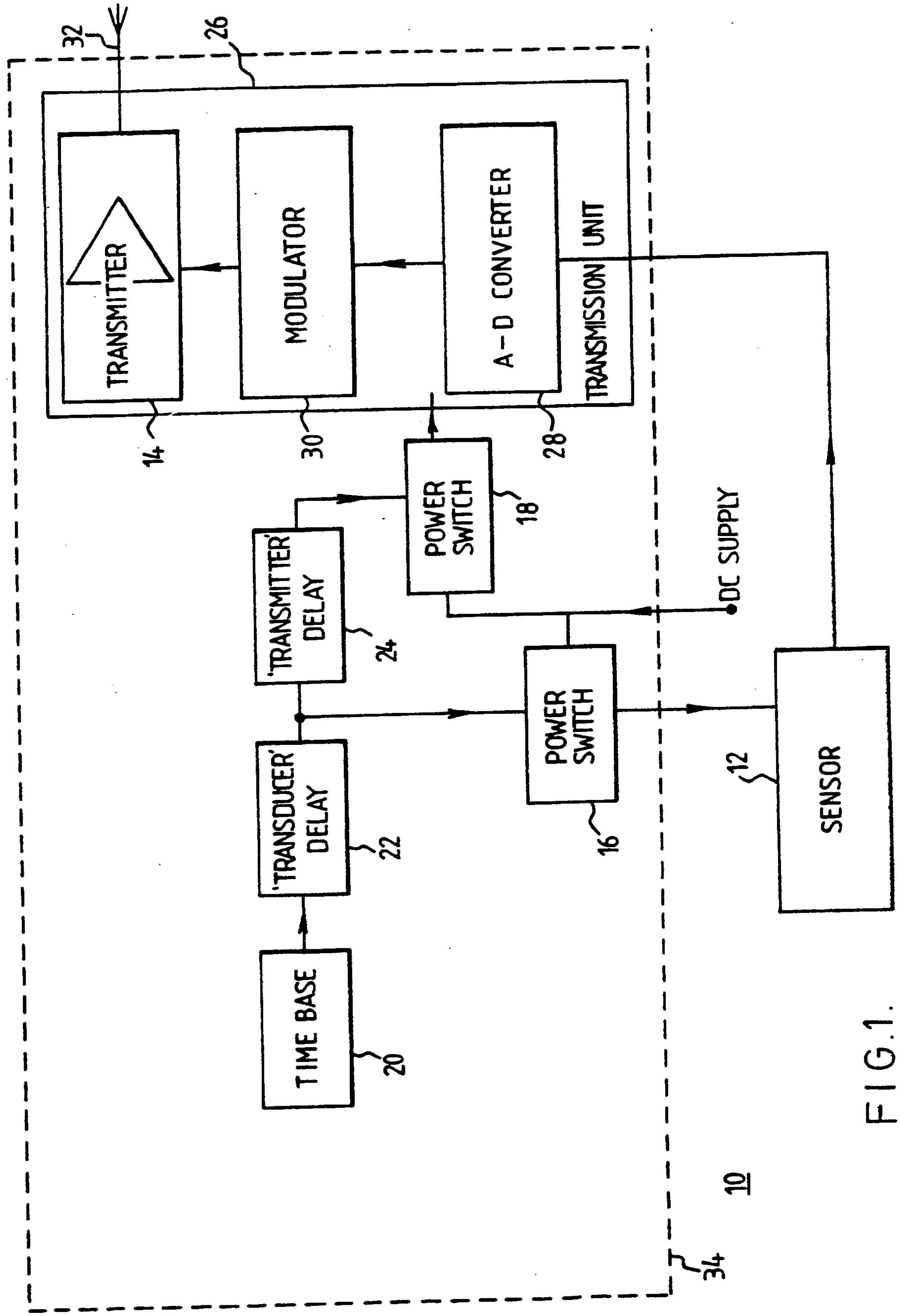

32
26
TRANSMITTER
MODULATOR
A-D CONVERTER
TRANSMISSION UNIT
14
30
28
POWER SWITCH
18
'TRANSMITTER' DELAY
24
DC SUPPLY
'TRANSDUCER' DELAY
22
POWER SWITCH
16
12
SENSOR
TIME BASE
20
10
34

FIG.1.

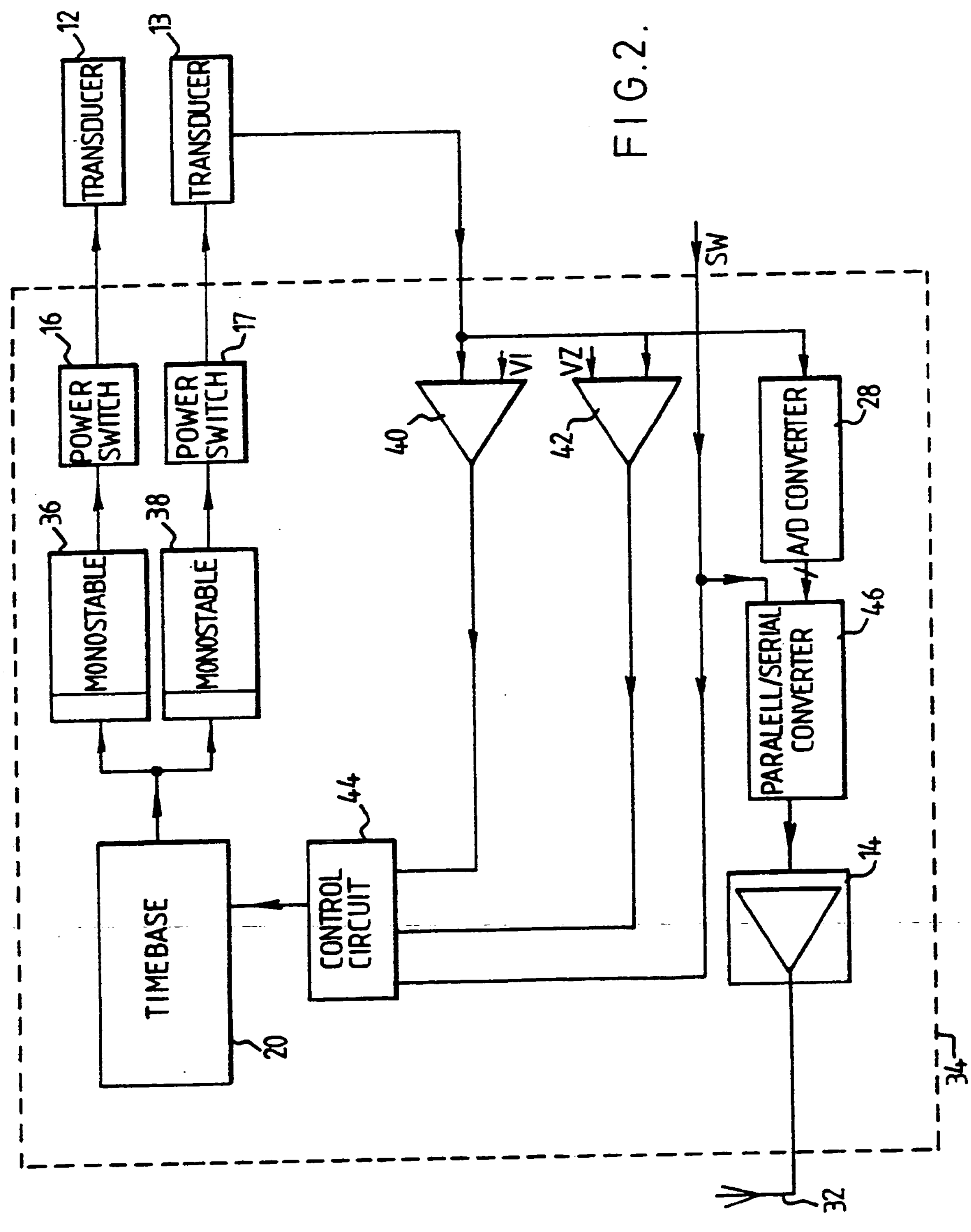

TRANSDUCER
12
TRANSDUCER
13
POWER SWITCH
16
POWER SWITCH
17
MONOSTABLE
36
MONOSTABLE
38
TIMEBASE
20
CONTROL CIRCUIT
44
V1
V2
40
42
SW
A/D CONVERTER
28
PARALELL/SERIAL CONVERTER
46
14
34
32

FIG.2.

A TELEMETRY DEVICE

The present invention relates to telemetry device of the type having a transmitter and a sensor in which the transmitter is arranged to transmit data obtained by the sensor.

Many conventional telemetry devices used radio transmitters to transmit various types of information, e.g. data, security warnings etc. The use of a radio transmitter can represent a significant saving in cost compared with the installation and maintenance of a communications cable, particularly over relatively large distances. In some circumstances, such as difficult terrain or lack of legal access across an area of land, the use of a radio transmitter is the only viable option. Often, these circumstances also dictate that the telemetry device should be battery powered, since no mains power service is available. In general, telemetry devices have a relatively high current drain which has a particularly adverse effect upon the useful lifetime of batteries. It is thus advantageous to reduce the current drain to a minimum.

The present invention provides a telemetry device in which current drain may be reduced.

According to the present invention there is provided a telemetry device having a transmitter and a sensor with the transmitter arranged to transmit data collected by the sensor, the device comprising: means for initiating data transmission at preset intervals, power control means for controlling the supply of power to the sensor and including time control means which control the time of commencement of the said supply of power and the duration for which power is supplied to the sensor such that data collection by the sensor is completed substantially at the time of each transmission.

Although the means for initiating data transmission can include a receiver which receives control signals from a remote device, an important practical embodiment of the invention involves only manual setting of the relevant parameters at the transmitter site.

The basic concept of the present invention can usefully be extended to suit particular applications. Specifically, the telemetry device can be enhanced so as to provide for a change in the period between data transmissions in accordance with some external trigger. Such a change could additionally or alternatively be from a fully quiescent state to the periodic transmission state.

It is to be noted that whereas the present invention is advantageous for implementation as a battery powered device, by virtue of the ability to reduce current

drain, the invention may also produce advantages when used to implement a telemetry device powered by a mains power supply.

Embodiments of the invention will now be described by way of example only and with reference to the accompanying drawings, in which:-

Figure 1 is a block circuit diagram of a telemetry device which embodies the present invention, and

Figure 2 is a block circuit diagram of an enhanced embodiment of the invention.

The telemetry device provides beneficial control of the "wake-up" duty-cycle of the sensor - that is, the period required for the sensor to obtain data within an acceptable range of accuracy. This parameter can vary considerably between different types of sensors. For example, a pulse-echo type transducer may require a minimum operative duration of three seconds whereas a doppler flow transducer may require an operative duration of eight seconds. Thus, the present invention provides control means whereby the duration of the operative mode of the sensor can be set to optimum values so as to reduce the current drain in a battery powered telemetry device. Furthermore, the operative mode of the sensor is initiated such that completion of data collection by the sensor coincides with the time at which the transmitter transmits the data.

Power supply to the sensor is reduced to a minimum and operation of the sensor coincides with data transmission by the transmitter.

The intervals at which the transmitter transmits data and the duration of the operative mode of the sensor are preferably adjustable so that a standard device can be pre-set to suit the requirements of a particular application. The required timing circuits can be implemented either with discrete components such as resistor-capacitor networks or can be implemented by digital control means. With digital control implementation, the various time periods are stored in a memory device.

It is to be noted that although the telemetry device includes means for initiating data transmission at pre-set intervals, such means may operate under the control of a remote device, which may be the same device as receives data transmitted by the telemetry device.

Figure 1 is a block diagram of one implementation of a telemetry device in accordance with the present invention. The device 10 comprises a sensor 12 and a transmitter 14. Transmitter 14 is preferably a radio transmitter of the frequency modulation type. The device 10 is powered from a dc power supply, which powers the sensor 12 and transmitter 14 via respective power switches 16 and 18. Power switches 16 and 18 are operated by a control circuit 20 which includes a time

base circuit. Output from the time base circuit is processed by a transducer delay circuit 22, the output of which controls power switch 16. Output from the transducer delay circuit 22 is further processed by a transmitter delay circuit 24 before being used to operate power switch 18.

The output from sensor 12 is of analog form and the device 10 contains a transmission unit 26, of which transmitter 14 forms a part. Transmission unit 26 includes an analog-to-digital converter 28 and a signal modulator 30. Transmitter 14 is, of course, provided with an aerial, 32. The transmission unit 26, power switches 16 and 18, control circuit 20 and delay circuits 22 and 24 may conveniently be housed within a single casing, as indicated by the outline 34.

The time base included in control circuit 20 may be implemented as an astable multivibrator the output of which is input into a binary divider circuit. The pulse repetition frequency of the time base determines the "wake-up" period for power to be supplied to the sensor 12 in its pre-operative mode. Transducer delay circuit 22 may be in the form of a monostable multivibrator which is triggered by the output from the time base. That is, the monostable multivibrator is triggered once in each cycle of the time base. The delay period is determined by a resistor-capacitor network.

Similar to the transducer delay circuit 22 the transmitter delay circuit 24 may also be implemented as a monostable multivibrator. In the case of circuit 24, the monostable multivibrator is triggered by the trailing edge of the transducer delay period. A resistor-capacitor network may be used to set the delay period in circuit 24.

Power switches 16 and 18 may be implemented as saturated bipolar transistors.

The analog-to-digital converter 28 should be a fast converter. Modulator 30 converts the parallel output from the analog-to-digital converter 28 into a serial code of the pulse duration modulation type, suitable for transmission. Serial output from modulator 30 drives the FM transmitter 14.

Sensor 12 is a dc energised transducer which produces an analog output. This could be replaced by a transducer providing a digital output, in which case analog-to-digital converter 28 would be omitted from the transmission unit 26.

It will be readily appreciated that the device 10 can be implemented such that the various parameters are to be set manually at the transmitter site. For example, by using manually variable resistors and/or manually variable capacitors in the delay networks. Such a 'manual only' device constitutes an important practical implementation of the invention. However, it

is also possible for control of the transmitter to be effected from a remote device. This can be implemented using the digital control technique mentioned above.

Figure 2 is a block diagram of a circuit which can be used to implement an enhanced embodiment of the invention. Benefically, the enhanced embodiment provides three modes of operation, with automatic switching therebetween. These modes of operation will be described with reference to one example of the applications in which the embodiment may be used, namely monitoring the level of a river.

In the first mode of operation the transmitter of the telemetry device is completely quiescent. That is, no data is transmitted when the river is below a certain level. As the river rises, a float switch is activated (contact is made or broken) and this causes the telemetry device to change to the second mode of operation. This mode may correspond to an 'alert' level for the river. In this mode of operation data concerning the height of the river is obtained and transmitted on a periodic basis. For example, a pulse echo transducer may be activated once every 30 minutes - such that subsequent to expiry of the transducer 'wake-up' period contemporaneous data transmission occurs.

If the level of the river continues to rise, the telemetry device is switched to the third mode of

operation - in which the interval between data transmissions becomes shorter, for example, the interval may be reduced to once every five minutes. This mode may correspond to an 'imminent flood' level for the river. The change from the second to the third mode of operation is triggered by a second float switch or by the output from a pulse echo transducer. That is, a digital contact may be made or broken or an analog signal falls or rises past a threshold value. The same or different transducers may be used to collect data in the second and third modes of operation.

As the river level subsides, the second float switch or pulse echo threshold detector causes the telemetry device to switch from the third mode of operation to the second mode. A continued fall in the river level causes the first float switch to change the telemetry device from the second mode of operation back to the first mode of operation.

A block diagram of a circuit to implement the described enhanced embodiment is illustrated in Figure 2. Components which correspond to those shown in Figure 1 use the same reference numerals. Detailed description of these components will not be repeated. It is also to be understood that, although not specifically illustrated, the transmitter is only operated periodically.

Timebase circuit 20 provides an output which is used to trigger two adjustable monostable multivibrators, 36 and 38. Output from the multivibrators 36 and 38 activate respective power switches 16 and 17. Activation of each power switch, 16 and 17, energises a respective transducer, 12 and 13. The specific form of transducer, 12 and 13, used will depend upon the particular application - and as described above they may, for example, be pulse echo transducers. At least one of the transducers (13) generates data for transmission. More than two transducers can be incorporated in the telemetry device, if desired.

Output from one of the transducers (13) is supplied to two or more comparators, two comparators 40 and 42 being illustrated. In each comparator, 40 and 42, the transducer output is compared with a respective reference voltage, V_1 and V_2. These reference, or 'set-point', voltages are adjustable. The comparators produce respective outputs which are supplied to a control circuit 44. An external switch SW, for example the above described first float switch, also provides an input for control circuit 44.

Control circuit 44 is connected to timebase circuit 20, so as to alter the rate of operation thereof in accordance with the inputs to the control circuit 44. Specifically, the rate of operation of the timebase 20 is set in accordance with the most recent output from

comparators 40 and 42 - subject to operation of the external switch SW. Thus, with control circuit 44 operating on the output from one of comparators 40 or 42, the rate of operation of timebase 20 depends upon the level of the signal output by transducer 13.

External switch, SW, preferably operates to switch the timebase circuit 20 ON or OFF, via control circuit 44. However, the external switch could alternatively be used to alter the rate of operation of the timebase 20.

Data transmission occurs after the transducers, 12 and 13, have been powered for a period of time to allow their readings to settle, that is after their respective 'wake-up' periods. Output from transducer 13 is supplied to an Analog-to-Digital converter 28. The multi-bit output of converter 28 is applied to a Parallel-to-Serial converter 46. Output from converter 46 is supplied to the transmitter 14. That is, the data is transmitted as a serial digital code representing the analog and digital inputs. An input to converter 46 is provided from the external switch, SW. Operation of switch SW can be arranged so as to stop data transmission.

It will be apparent from the foregoing description that the basic telemetry device can be enhanced so as to provide for a change in the period between data transmissions in accordance with some external trigger. Such a change can additionally or alternatively switch

the device from a fully quiescent state to a periodic transmission state. Moreover, the switching between states or modes can be initiated by analog and/or digital signals.

Various modifications, which will be readily apparent to those skilled in the art, may be made without departing from the scope of the present invention. In particular, whereas the above description has been directed to an arrangement using a radio transmitter, the invention is equally applicable to any other form of transmitter. For example, use of an ultrasonic transmitter may be beneficial where the sensor is housed in a marine bouy.

CLAIMS:

1. A telemetry device having a transmitter and a sensor with the transmitter arranged to transmit data collected by the sensor, the device comprising:

means for initiating data transmission at preset intervals, and

power control means for controlling the supply of power to the sensor and including time control means which control the time of commencment of the said supply of power and the duration for which power is supplied to the sensor such that data collection by the sensor is completed substantially at the time of each transmission.

2. A telemetry device as claimed in claim 1, comprising means for manually setting the preset intervals and duration for which power is supplied to the sensor.

3. A telemetry device as claimed in claim 1, wherein the means for initiating data transmission comprises a receiver which receives control signals from a remote device.

4. A telemetry device as claimed in claim 3, wherein the time control means receives control signals from the said receiver.

5. A telemetry device as claimed in claim 1, wherein the time control means includes a time base circuit comprising an astable multivibrator.

6. A telemetry device as claimed in claim 5, wherein the power control means comprises a first delay circuit and a first power switching element, the delay circuit comprising a first monostable multivibrator triggered by output from the time base circuit.

7. A telemetry device as claimed in claim 6, wherein the means for initiating data transmission comprises a second delay circuit including a second monostable multivibrator and a second power switching element, the second monostable multivibrator being triggered by the trailing edge of the delay period produced by the first delay circuit.

8. A telemetry device as claimed in claim 7, wherein the first and second power switching elements are respective saturated bipolar transistors.

9. A telemetry device as claimed in any preceding claim, wherein the sensor produces an analog output and the device further includes an analog-to-digital converter which operates on output from the sensor.

10. A telemetry device as claimed in claim 9, further comprising a pulse duration modulator which processes output from the analog-to-digital converter and provides the input for the transmitter.

11. A telemetry device as claimed in claim 1, further comprising an automatically operable switch the operation of which causes the means for initiating data transmission and the time control means to respond such that data transmission occurs at second preset intervals.

12. A telemetry device as claimed in claim 1 or claim 11, further comprising an automatically operable switch the operation of which activates and de-activates the means for initiating data transmission.

13. A telemetry device substantially as hereinbefore described with reference to and as illustrated in Figure 1 of the accompanying drawings.

14. A telemetry device substantially as hereinbefore described with reference to and as illustrated in Figure 2 of the accompanying drawings.

Published 1988 at The Patent Office. State House, 66/71 High Holborn, London WC1R 4TP. Further copies may be obtained from The Patent Office, Sales Branch, St Mary Cray, Orpington, Kent BR5 3RD. Printed by Multiplex techniques ltd, St Mary Cray, Kent. Con. 1/87.